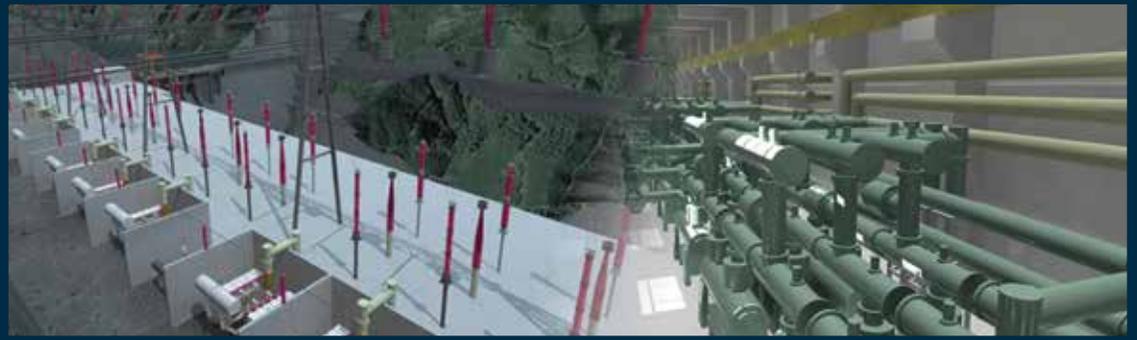




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Project Summary

Organization:

HydroChina Zhongnan Engineering Corporation

Solution:

Power Generation

Location:

Diqing, Yunnan Province, China

Project Objective:

- Design, build, and commission 1,400 MW hydropower station in 75 months.
- Facilitate collaboration for team in three office locations.
- Implement 3D technology to accelerate design and streamline workflow.

Products Used Include:

MicroStation, Bentley Architecture, ProjectWise, Bentley PlantSpace, Bentley Substation, GEOPAK Civil Engineering Suite

Fast Facts

- Schedule: 24 months preparation, 39 months construction, and 12 months post-construction.
- Team completed feasibility design work within 40 days of implementing Bentley solutions.
- ProjectWise ensured that standardized design work and document controls.

ROI

- ProjectWise reduced standards management costs by 50 percent.
- 3D visualization of layouts shortened design time from one or two weeks to less than eight hours.
- Clash resolution significantly reduced errors, omissions, and conflicts and raised work product accuracy by 80 to 90 percent.
- Final drawing production time was reduced from 2-3 days to one day.
- 3D collaborative design technology shortened design from six months to 39 days.

HydroChina Zhongnan Shortens Tuoba Hydropower Station Feasibility Design Phase by 80 Percent

Using Bentley's 3D Design Technology Facilitates Multidiscipline Collaboration, Coordination, and Standardization

First 3D Collaborative Design Project

HydroChina Zhongnan Engineering Corporation (HydroChina Zhongnan) is an award-winning engineering, procurement and construction (EPC) consultancy mainly engaged in contracting for hydro- and wind-power projects. The \$2.41 billion Tuoba Hydropower Station in China's Yunnan Province was completed on schedule in 2010 with an installed capacity of 1,400 megawatts. HydroChina Zhongnan implemented Bentley's 3D collaborative design technology to shorten design work from six months to 39 days, thus helping to meet an aggressive 24-month design-phase schedule.

Design efficiency, project team communication, and multidiscipline cooperation were improved by using ProjectWise® and Bentley Navigator in conjunction with Bentley PlantSpace®, Bentley Architecture, Structural Modeler, Bentley Substation®, promis•e®, and GEOPAK® Civil Engineering Suite™.

ProjectWise connected onsite designers with HydroChina Zhongnan headquarters in Changsha, Hunan, ensuring that everyone used the enterprise standards and latest file versions. This technology reduced the costs associated with managing enterprise standards by 50 percent.

Site and Schedule Constraints

Founded in 1949, HydroChina Zhongnan has worked with the People's Republic of China to develop hydropower, water conservancy, and new energy projects throughout China. The Tuoba Hydropower Station is the fourth of China's cascade dams on the Lancangjiang River. The product not only produces an annual average energy output of 6.36 billion kilowatt hours but also provides a reservoir storage capacity of 1.04 billion cubic meters. Together the power and water resources will boost economic development in the region.

The station was built within the site constraints and under poor conditions for onsite layout. To meet the aggressive 75-month project schedule – 24 months for preparation, 39 months for construction, and 12 months for post-construction – HydroChina Zhongnan created a 60- to 80- member project team distributed among office locations onsite, at the Changsha headquarters, and in Diqing, Yunnan province.

The complex hydraulic engineering project involved multiple disciplines including survey and mapping, geology, construction, civil engineering, water turbine engineering, electrical engineering, and architecture. In the past, all project files were distributed to designers and specific reviewers for file review. Document control and review were challenging. The institute's existing 2D design software did not support project goals for 3D collaborative design, coordination among disciplines, and document control and standardization.



GEOPAK Civil Engineering Suite helps designers directly address on-site topographic constraints.

Specialized Applications Accelerate Design

HydroChina Zhongnan selected Bentley's comprehensive 3D design software portfolio to improve workflow efficiency, facilitate collaboration among disciplines, and improve project management. Within just 40 days, the institute was able to apply the various specialized software to the project design work, despite being unfamiliar with the products. This achievement was made possible by the designers' quick learning and thorough exploration of the Bentley software.

Specialized applications included ProjectWise for connecting people and information across distributed teams; Bentley Navigator for dynamic project review and analysis; Bentley PlantSpace applications for full-scale facility design and construction; Bentley Architecture for architectural building information modeling (BIM); Structural Modeler for BIM design and documentation of structural systems;

“By leveraging the key features of Navigator and i-models, six months of design work was reduced to 39 days with the same number of designers involved.”

— Gong Deyu, chief engineer, Tuoba Hydro Power Station Project, HydroChina Zhongnan

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Bentley Substation for integrated electrical and physical design of intelligent substations; promi•e for electrical control system design; and GEOPAK Civil Engineering Suite for road and transportation infrastructure design.

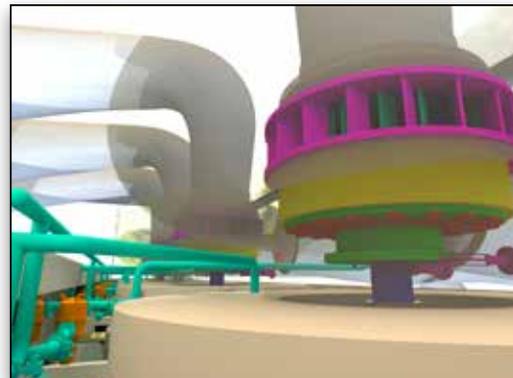
In the collaborative design environment provided by Bentley, several specialized teams were able to use the applications to work concurrently on one design project and refer to the design works amongst themselves at any time. This dramatically shortened the time period for cooperation among specialized teams, and improved both teamwork and design efficiency. ProjectWise ensured that design work was standardized, no matter where it was performed or by what discipline. Document controlling was streamlined, and project management efficiency improved greatly with ProjectWise.

3D Models Visualize Spatial Layouts

Bentley's 3D design technology provided clearer, more visual and vivid expressions of the design work. In 3D, the spatial layout relationships of structures and equipment were readily apparent. Many spatial layout patterns that were difficult to realize in 2D were easily realized in a 3D design environment. Moreover, equipment with complicated shapes could be dynamically presented in multiple dimensions, making them clearly visible at a glance. This technology shortened layout design time from one or two weeks to less than eight hours.

Clash resolution and model verification were performed to reduce errors, omissions, and conflicts in structural interior layouts, making designs more rational and optimizing the use of space. The clash resolution function of Bentley software significantly reduced errors, omissions, and conflicts among the specialized teams and raised work product accuracy by 80 to 90 percent. This drastically reduced the time required for designers to handle structural and component collisions at the construction site. According to Gong Deyu, chief engineer, Tuoba Hydropower Station project, “By leveraging the key features of Bentley Navigator and i-models, six months of design work was reduced to 39 days, with the same number of designers involved.”

Three dimensional design also showed tremendous advantages during the early comparison and selection of dam engineering plans, according to He Leihui, an engineer at the Tuoba Hydropower Station. “It only took five to eight hours



Bentley's 3D design environment provides accurate plant layout visualization.

for us to complete an excavation plan with GEOPAK and other 3D software from Bentley,” he said. “In the past, we had to spend two weeks to work it out. Moreover, Bentley software enabled us to perform fast and more accurate project workload statistics.”

The 3D models were used to plot 2D drawings, generate automatic project workload projections, and reduce follow-up design workloads. Final drawing production time was reduced from two or three days to just one day. Gong Deyu explains, “Using 3D models enabled us to optimize the whole design cycle, including automating 2D drawing generation and project workload calculation, thus reducing design time and improving efficiency.”

Design Information Supports Operations

HydroChina Zhongnan's implementation of 3D collaborative design technology benefited the plant owner-operator as well. By establishing an engineering database for the project, material and maintenance information for the whole lifecycle of the power station was provided in a unified way, ensuring the effectiveness, accuracy, and consistency of the data. Management of device maintenance, staff training, and report presentation were implemented easily and quickly with the 3D models. As a result, system operation and staff work efficiency improved greatly.